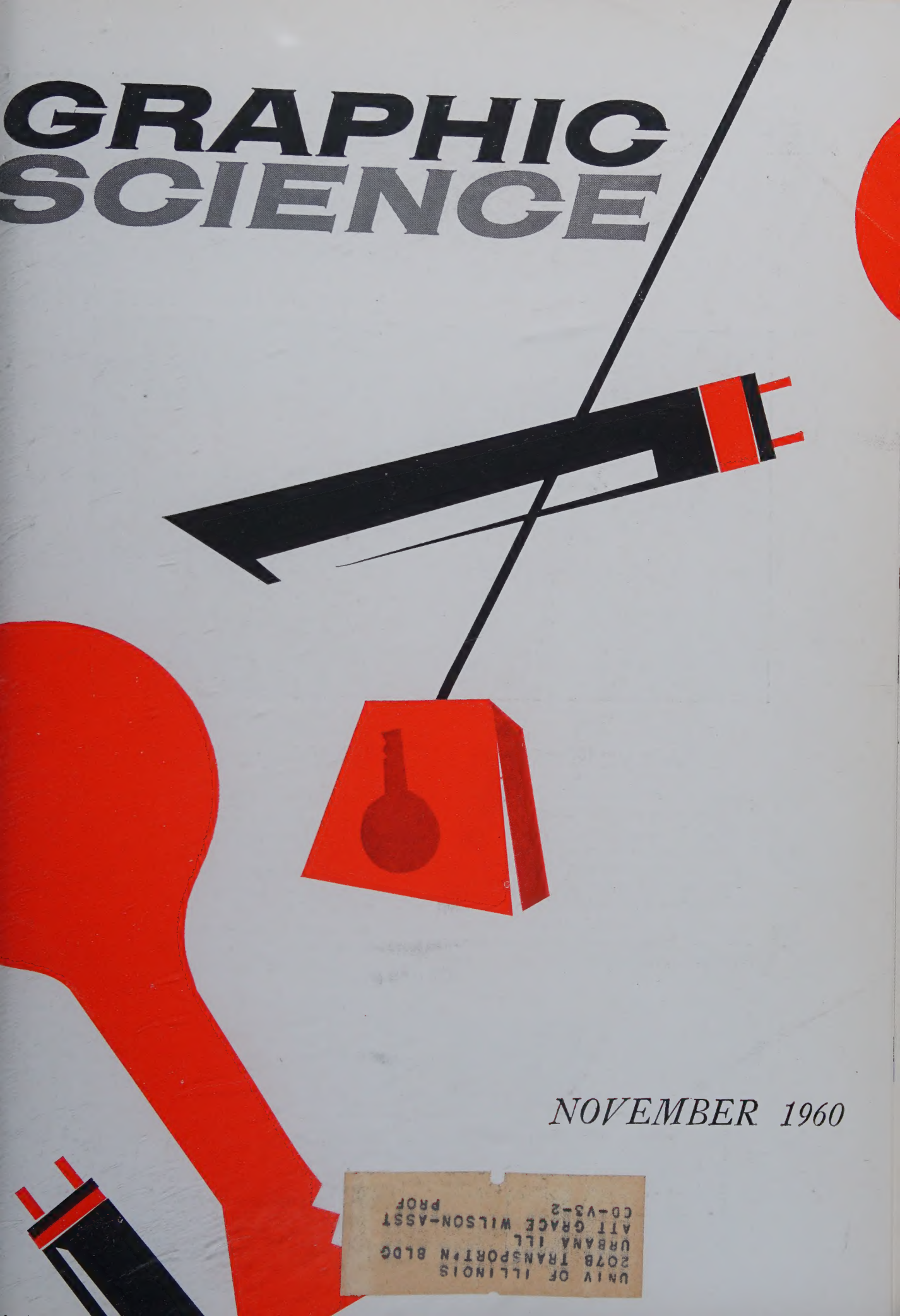
GRAPHIC SCIENCE



NOVEMBER 1960

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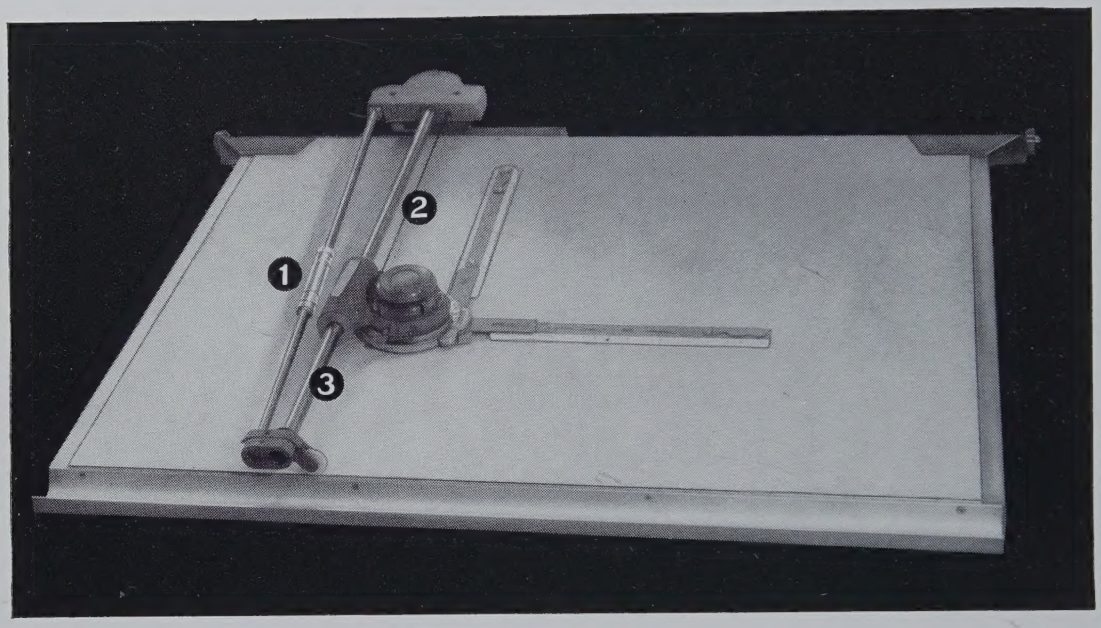

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GRAPHIC SCIENCE

THIS ISSUE: 11,600 COPIES

NOVEMBER 1960

VOLUME 2 NUMBER 11

The Magazine of engineering drawing management, covering drafting, reproduction and microfilming, technical illustration, drawing standards and drawing filing in all industries.

ARTICLES

DEPARTMENTS

RAPHIC SCIENCE is published monthly by inelow Publishing Company, Inc., 103 Park venue, New York 17, N. Y. (MUrray Hill 5-1745). harles E. Rhine, president; Paul Yake, vice resident; David Z. Orlow, secretary-treasurer. RAPHIC SCIENCE is published (printed) at 116 Main St., Norwalk, Conn. Address changes, undeliverable copies, and orders for subscriptions should be sent to Editorial Offices, 103 Park Avenue, New York 17, N. Y.

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Letters

Mil Standards

Sirs:

I would first like to express my thanks for your magazine, which I have read and circulated throughout my department since the first publication. It is so well read by the draftsmen, it takes several months to circulate through a group of 25 people.

The articles have always been excellent, but those that prompted this letter were in the August 1960 issue, discussing MIL-D-70327. After reading these articles, I realized I had companionship in the "forest of MIL STD confusion."

I, too, would be interested in information regarding "average drafting and checking time." However, I believe this has to be determined by experience, using the conditions that exist in your own company. It is a problem to estimate drafting jobs accurately without some actual historic records. To collect this data with a minimum of extra paper work and accounting is difficult.

Realizing that a time/dwg. history will never exist unless you start compiling it, I recently started a system to collect the time on the tracing. Each draftsman will write the number of hours to originate the drawing on the tracing in the lower right-hand border. The checking time, correction, recheck and recorrection time will be entered in the border also. The drafting hours will be prefixed with "D" and the checking time with "C." This will be done in pencil for later erasure when necessary. The draftsmen have been told to keep a "log" on any drawing where the time was excessive due to changes while the original drawing was being executed or checked. Of course, this has to be done on the honor system as there is no check to see that the actual time is entered, but cutting the time entered will soon result in an inaccurate history, low estimates, money lost on each job, and eventually less jobs for the draftsmen.

It is hoped that after a year and several jobs have passed, I will b able to review a request for an est mate, pull out the history on a com parable type of job, and be on firm ground in quoting a drawing cos figure.

GEORGE A. ASHWOO

Head, Drafting & Documentation
General Mills, Inc.
Mechanical Division
1620 Central Ave., N.E.
Minneapolis 13, Minnesota

Sirs:

My Office deals in the developmen and preparation of Military specifica tions and Military standards for th Bureau of Naval Weapons, Washing ton, D. C., and in much of this wor we are involved in engineering draft ing, reproduction, and drawing stand ards. We were particularly intereste in the industry comments on Specif cation MIL-D-70327 in the Augus 1960 issue.

D. D. STRATTO

Head Engineer
Technical Standards Office
Naval Air Material Center
Philadelphia 12, Pa.

Sirs:

Although long overdue, I wish t express my appreciation for your e forts. Almost every month some artic in your magazine strikes a responsiv chord within my organization. It reassuring, in a way, to find that ou perplexing problems are common t others in industry. Your publicatio may well offer the clearing house fo analysis of these areas. The Augu issue, for example introduced a fe more opinions and issues to g with our discussions of MIL-D-7032 Mr. Glie and Mr. Thomas were ce tainly "ghost members" during ou conferences.

G. Goo

Chief Draftsman
Hughes Communications Division
Hughes Aircraft Company
Los Angeles 45, Calif.

(What's wrong with this picture?)

Is your materials-handling equipment years ahead of your engineering-design equipment?

Materials-handling techniques have made great strides during the past decade—and efficient handling *is* basic to productivity. But *drafting* equipment, too, needs to stay with the times. Are your professional engineer-draftsmen *really* equipped to realize their full potential?

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Hamilton L-Contour Table
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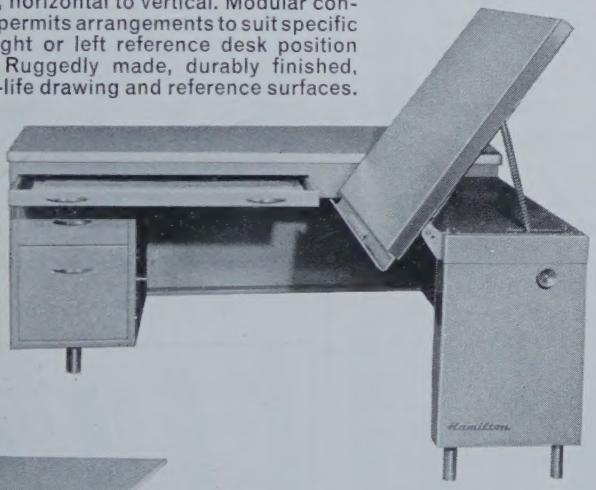

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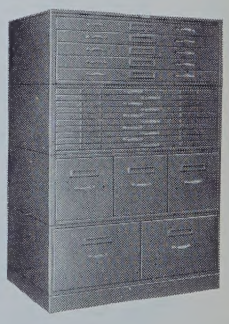

Drafting-Printmaking Booklet reports new techniques for solving engineering and production problems

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Notes & Comment

Military Engineering News; New Associate Editor

BEGINNING THIS MONTH, a new department authored by William S. Hutchinson will bring to GRAPHIC SCIENCE readers the latest developments in documenting military engineering practices.

Mr. Hutchinson is Assistant Chief, Mechanical and Engineering Programs Branch, Standardization Division, Armed Forces Supply Support Center. All material appearing in the column will have been approved by the Armed Forces Supply Support Center from a policy standpoint.

In addition, Mr. Hutchinson has accepted the honorary title of Associate Editor. He will be available for response to the comments and suggestions of readers.

As Assistant Chief, Mr. Hutchinson is directly responsible for program management of the DOD Engineering Data Micro-Reproduction System, as well as studies in the new area of DOD Engineering Documentation Systems. Objectives of this project include attaining integrated systems for engineering data in support of research and development, as well as follow-on support of procurement, production, inventory management and maintenance operations. Also, data collection, automation, rapid machine search, selection (including by computer), and precise transmission. He is a Registered Professional Engineer, District of Columbia.

We welcome you, Bill, to GRAPHIC SCIENCE.—*The Editors*

Board of Directors

AMONG OTHERS recently elected to the Board of Directors of the Design and Drafting Council of Delaware Valley is John R. Carpenter, Burroughs Corp., Paoli, a valued contributor to GRAPHIC SCIENCE. (See page 13, this issue; also page 22 in the May 1960 issue.)

Scholarship

ONE-DAY Seminars on "Reducing Costs in Drafting and Design Operations" were held in late August at leading hotels in New York, Philadelphia, Chicago, Cleveland and Cincinnati. Sponsored by the Industrial Education Institute, 221 Columbus Ave., Boston 16, Mass., these Seminars were conducted by Don Fuller, Director, Drafting & Design Division of the I.E.I. The program included discussion of organization and planning for maximum efficiency, special problems in drafting and engineering offices, and the components of an effective cost reduction program. These one-day Seminars were developed for men with experience in supervisory or managerial positions. Each person attending received take-home material, consisting of notes, bibliography, tables and charts, as an aid in applying information gained at the Seminar.

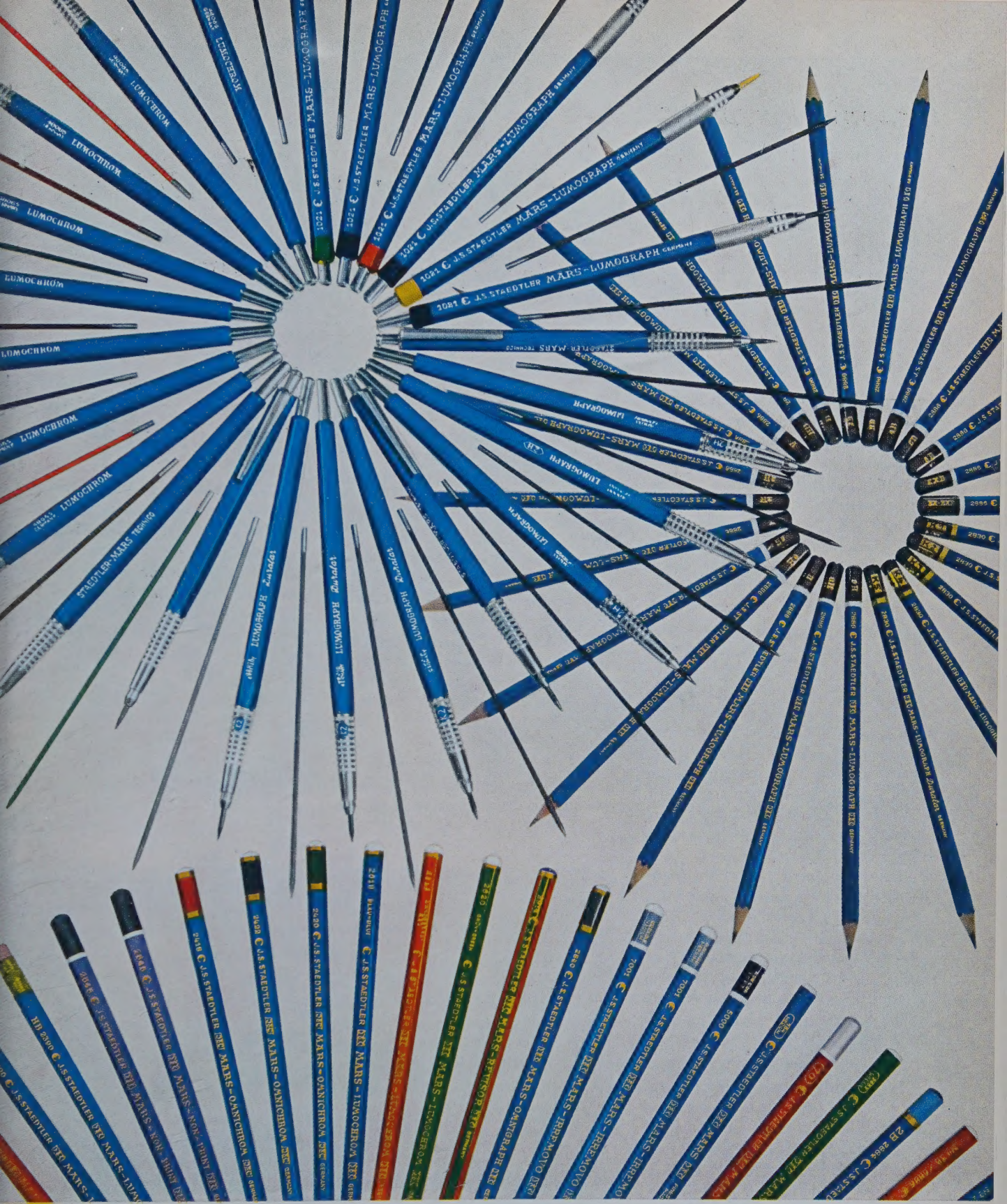
Visit Graphic Science at the VCC in Chicago

AN INVITED EXHIBIT of antique drawing instruments of historic note and interest will be displayed as the highlight of the GRAPHIC SCIENCE booth at the 4th Annual Visual Communications Congress in Chicago next month.

Dates of the show are December 3, 4, 5, and 6 at the Hotel Sherman.

If you are in Chicago then, be sure to stop in at Booth 98 where the Editor and Publisher will be pleased to welcome you.

The Show will also contain exhibits by numerous companies in the drafting and reproduction fields.



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Graphic Perspective

The History of Technical Drawing

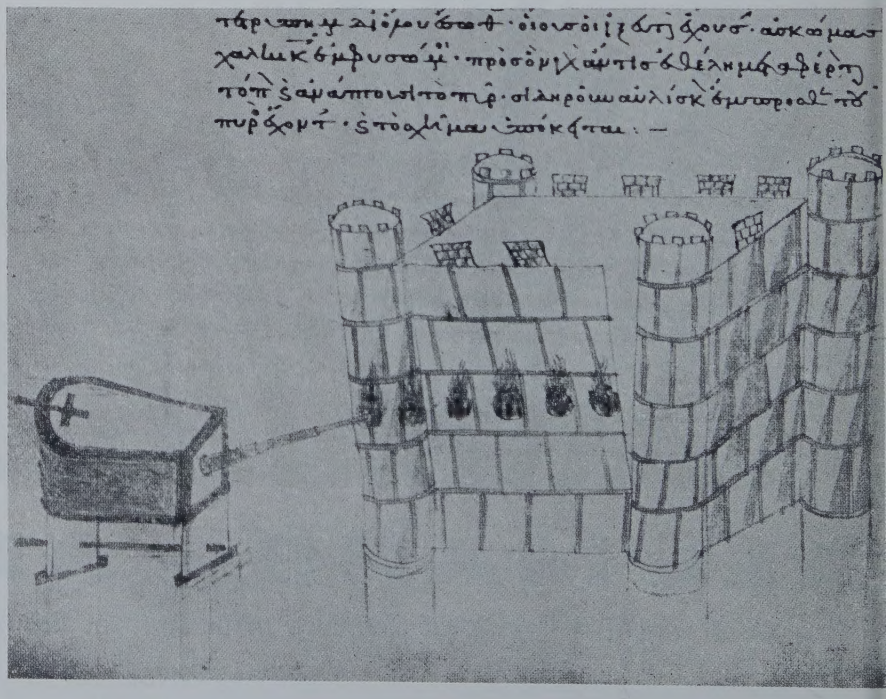
Prehistoric Times, Antiquity, and the Middle Ages

by Franz Maria Feldhaus

THE SITES excavated in Herculaneum and Pompeii were treasure troves of the little things used in everyday life. When excavating in 1709, marble figures were found, but no one took any interest, and they were sold to a stone mason. A Frenchman who was building a house for the Commandant of the Austrian occupation near Naples saw them there, and drew attention to them. Excavations were continued in 1711. At a depth of 45 meters, marble statues were found, and it was realized that this was the site of a buried town. Starting in 1738, tunnels were driven along the streets, and anything that looked like art, was taken; after a time, however, this was abandoned and covered up again. Not until 1927 was Herculaneum dug up systematically with the help of hammers operated by compressed air. The neighboring city of Pompeii has also been uncovered, beginning in 1748. Originally, everything found there was put into the museum at Naples without any notes having been made as to where it was found. Valuable records of old techniques are kept in its overfilled halls and vaults. Among them can be found pencils, dividers, calipers, rulers, angles and parallel rules, as well as metal carpenters' rules, the latter exactly like the ones used today.

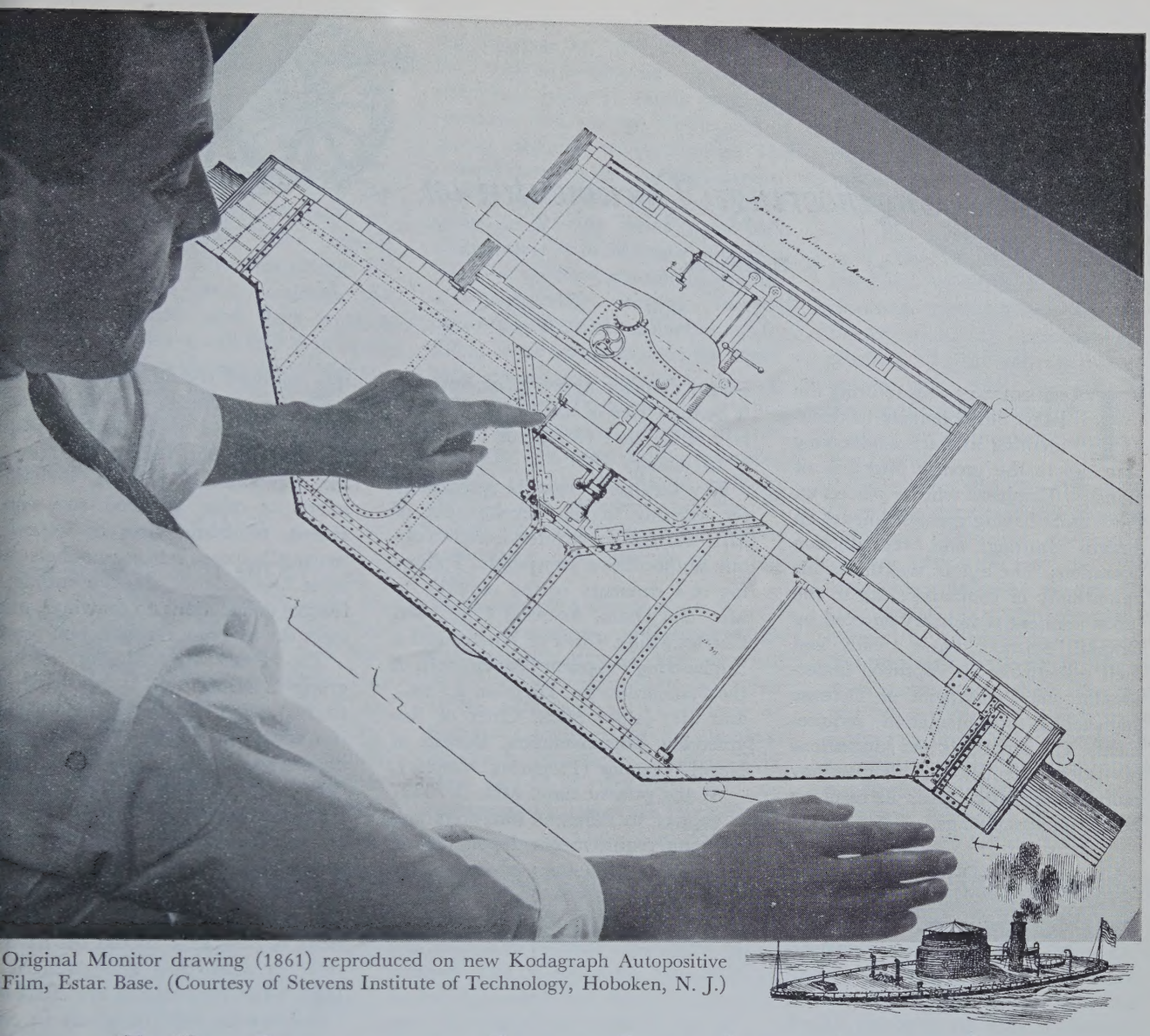
Very little has been published about drawing utensils used by the Romans; some of it is in the combined work by Hugo Blümner, and he was able to bring out only the first volume of his large work in a new edition. If one could examine the objects buried by the eruption of Vesuvius on the 25th of August in the year 1879, and now in the National Museum in Naples, many interesting facts regarding drawing implements would no doubt be brought to light. Metal pieces are, without exception, made of bronze. Articles found in Herculaneum that were made of wood had carbonized, because a layer of concrete—consisting of volcanic ash and pumice stone 20 meters thick—formed during rain that lasted for days. This sealed everything off completely from the air. In Pompeii, however, the lava, sand, pumice stone and ashes from the fallout of Vesuvius were deposited dry in a layer 4.5 meters thick. The air was therefore able to penetrate, and with the passing of time the wood perished. In its place, hollows were left, and these were filled in by spraying them with plaster of Paris. What was once made of wood could then, reproduced in this manner, be dug out. It is known that the peoples of antiquity had a high cultural standard. They employed surveyors who knew how to take exact measurements. We therefore conclude that their findings

(*Continued on page* 20)



FLAME thrower for heating stone walls. ***(Drawing from the Appollodoros-Codex, 11th century. Vatican Library, Rome).***

This chapter comprises the remainder of Part I of an authoritative and beautiful book, THE HISTORY OF TECHNICAL DRAWING, *by Franz Maria Feldhaus published in 1959 by Franz Khulmann, K.G., of Wilhelmshaven, Germany, as* GESCHICHTE DES TECHNISCHEN ZEICHNENS. *We are indebted to the publisher for the translation, as well as for permission to republish this fascinating work. It will be continued in this department from month to month, until completed. The first chapter appeared last month.—The Editors.*



Original Monitor drawing (1861) reproduced on new Kodagraph Autopositive Film, Estar Base. (Courtesy of Stevens Institute of Technology, Hoboken, N. J.)

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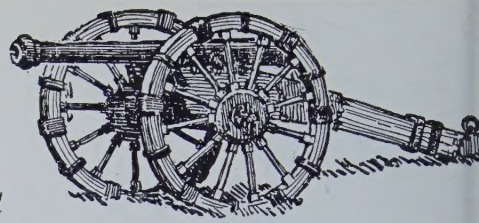


Military Engineering Documentation

by W. S. Hutchinson

THIS COLUMN aims to bring the latest developments in documenting military engineering practices to the prompt attention of industry. Emphasis will be placed on those areas having greatest impact on design, drafting and reproduction operations. The author welcomes this opportunity of communicating to the broad segment of industry covered by Graphic Science, those trends and facts essential to an improved understanding of Department of Defense engineering documentation requirements. The comments and suggestions of readers are solicited so that we may mutually exchange ideas in reaching better understandings.

MIL-D-70327

THIS SPECIFICATION, defining military requirements for "Engineering Drawings and Associated Lists," has enjoyed considerable interest and discussion since its approval March 16, 1959. With a year's experience behind the military, certain ambiguities in interpretation have become evident. A number of deficiencies in referenced documents likewise require correcting. Consequently, the Armed Forces Supply Support Center assigned project DRPR-0036 to the Bureau of Naval Weapons for a comprehensive revision.

Military activities and industry groups are now studying a draft of Revision A that has been circulated by BuWeps. The industry groups will meet 1, 2 and 3 November in Washington, D. C. to consolidate the industry position. The DOD Drawing Practices Committee plans to convene shortly thereafter to reconcile both the military and industry comments. Target date for approval of Revision A by the Office of the Assistant Secretary of Defense (Supply & Logistics) is 15 January 1961.

Key defense personnel responsible for assisting in the development of MIL-D-70327 were interviewed to obtain authoritative viewpoints. Following is a summary of the remarks by Mr. John Dunn, Assistant Chief, Mr. Charles Miller, Chief of Mechanical & Engineering Programs Branch, both of the Standardization Division, AFSSC, and Mr. James Mars, Chief of Engineering Documentation, Bureau of Naval Weapons (Preparing Activity).

At the present time, MIL-D-70327 is subject to different interpretations of some requirements depending on the varying practices of individual contractors. Revision A should reduce controversial meanings to a minimum by removing a number of options and clarifying the intent of each requirement. A table has been included in the specification to identify the conditions which will govern the requirements for furnishing drawings and minimum support data. The basic intent of MIL-D-70327 is not to increase the quantity of drawings purchased by military activities, but rather to ensure that all drawings received are technically complete, accurate, legible (including micro-reproduction), and adequate for all specified uses. Mr. Dunn reiterated, "Affirmatively, we are trying to reduce the number of drawings required, and to assure that they are consistent with the minimum requirements of the military services."

Instructions for the preparation of drawings are contained in referenced Military Standards 1 through 31. Some of the problems in complying with the specification stem from options and present inadequacies in these standards. MIL-STD-1, General Drawing Practice, is an example. In order to obtain satisfactory microfilm, this standard should contain requir ments for producing microfilm imag of lettering and lines with acceptab legibility through four generations the reproduction process, includi micro or other reduced size cop Hence, minimum sizes of letterin spacing between letters, numbers a lines, line weights, and the outline feature delineations on drawings, mu meet the exacting reproduction nee

The DOD microfilming worki group (EDMS-0001) has recent studied these requirements in deta run tests, and forwarded recomme dations to AFSSC for the correction deficiencies. MIL-STD-1 is present being revised by the Signal Corps incorporate the new microfilming r quirements.

Another example: MIL-STDs 1, and 29 all contain drafting conve tions. A contractor should not have refer to more than one standard learn what conventions are standa Consideration will be given to co solidating all conventions in MI STD-1.

As the result of MIL-D-703 being invoked in contracts, the S vices report that troubles in rep curing spare parts are disappearin Much difficulty was experienced p viously in reprocuring parts by mea of drawings prepared under p visions of predecessor specificatio It was found that such drawings ma times were incomplete or otherw unsuitable for procurement from oth than the original source even thou they were acquired with unlimit rights clauses in contracts for t specific purpose. When different pa are furnished on successive procu ments, or when the same parts identified by different drawing nu bers, supply support becomes exc sively costly. It is vital that ris costs to support equipments be h to a minimum. Complete and accur technical documentation of ite

---

Mr. Hutchinson is Assistant Chief, Mechanical and Engineering Programs Branch, Standardization Division, Armed Forces Supply Support Center.

initially is an absolute essential in maintaining interchangeability.

Defense officials agree that notwithstanding problems still to be solved in clearly specifying engineering documentation requirements, tangible benefits resulting from the implementation of MIL-D-70327 are increasingly evident. They express confidence that when remaining deficiencies have been removed, the military services and their weapon system contractor will find their operations considerably simplified. The cooperation from industry in stepping forward to assist the Department of Defense in this program is highly commendable.

MIL-STD-2B

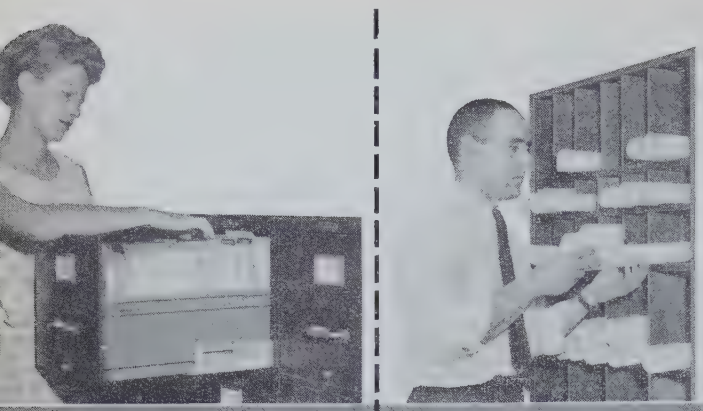
THIS REVISION of MIL-STDs 2, 3 and 4, approved August 25, 1960, continues MIL-STD-2B, "Engineering Drawings, Sizes and Formats," for identification purposes, and supersedes (discontinues) MIL-STDs 3 and 4. All military requirements are now included in the one standard for sizes of drawing sheets, various "blocks" normally shown on engineering drawings for title, drawing number, record information (preparing, checking, approval, etc.), parts list, revisions, and certain supplementary blocks used only when required. The revised standard also contains requirements for match lines which are added to drawing sheets to facilitate single frame or multi-frame microfilming. The standard permits preprinting of engineering drawing formats. Minor modifications to the formats for filling in of information in the standard "blocks" is acceptable to the military services. In order that existing stocks of preprinted drawing formats, prepared according to the superseded military standards may be used up, AFSSC has recommended the issuance of departmental instructions authorizing their use up to 1 July 1961.

Engineering Documentation

The Department of Defense standardization program in this area will be the subject discussed by the author at the 11th National Conference on Standards, sponsored by the American Standards Association in New York City on 25-27 October. We are moving into a new era in the management of engineering data. The close integration of systems for documenting the data vitally concerns the Department of Defense. Engineering drawings are being prepared for the military services at an average rate of 500,000 each month. These drawings find many uses in addition to production of initial material. With increased centralized procurements, drawings have extensive uses for 1) identification, 2) provisioning, 3) stocking, 4) interchangeability determinations, and 5) interchange among the military services and contractors for maintenance and day-to-day operations.

One basic objective, therefore, is to reduce drastically the number of individual drawings prepared by various contractors for the government which delineate the same item. One military activity recently discovered, for instance, that as many as 500 drawings are on file for the same or interchangeable item. The necessity for maintaining records in such manner is excessively wasteful. It is a primary reason for the extensive duplication in cataloging and stocking of supply items for logistic support.

(What's wrong with this picture?)



Are your "dead storage" files more efficient than your active drafting files?

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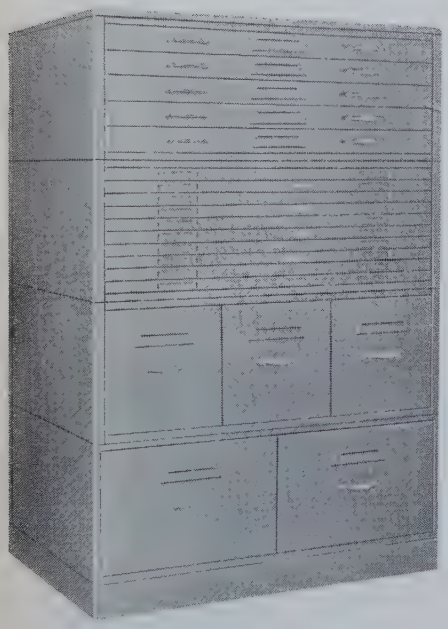

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Hamilton Plan Files
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GRAPHIC SCIENCE

NOVEMBER, 1960

VOLUME 2 NUMBER 11

Draftsmen Are Technical Communicators

Some basic information for educators on the conditions, procedures and techniques used in industrial design and drafting

by John R. Carpenter

OUR BUSINESS is communication characterized by a mild disinterest in esthetic quality and a burning urgency for clear, crisp, accuracy. To achieve this we use a special graphic language, a pictorial form unique in that it permits total definition of the thing pictured. But we may not ever forget that the reader of this picture is as important as its maker. It takes two to communicate. Our language is circumscribed by procedural rules which, for the most part, we follow. However, if the communication can be improved thereby, we will happily burst these limits. We will use words, natural pictures, various reproduction techniques, mechanical aides, anything. No convention can stand unbent before the all-important need that the communication be sent and received completely, accurately, and understandably.

Let's try to clarify just who is sending this information we are talking about, and who is supposed to receive it, and let's ask the obvious question of why is it sent? Drawings take a long time to make, and a draftsman's labor is unprofitable. The cost to industry in time, effort, and money is colossal. The work is done by men who are years acquiring their skills. They consume gobs of equipment, material, and real estate. And their total end-result is reams of graphite-covered paper. My office produces weekly about 70,000 square feet of blueprint. This paper is inedible. It's impossible to ride in it, or to wear it, or to direct and control missiles with it. All it's good for is to occupy space in very special and very expensive cabinets.

Why do we bother? It stands to reason that we must, or we wouldn't. To explain this, it is necessary first to put a conventional industrial set-up in its proper perspective. Among too many draftsmen there exists the assumption that the whole business starts and ends with them. This is both unfunny and untrue. In order to get anything made, two kinds of people are essential. One is the creator, and the other is the maker. We call them the engineer and the fabricator. Please note that I have omitted the draftsman. He is badly needed all right, but he is not essential. Anything can get made without him just by the business of the engineer talking to the fabricator, and telling him what he wants. If the connection between the two is sufficiently intimate, the gimmick will be produced. I am sure you are all familiar with Edison's famous sketch of the phonograph, on the bottom of which he had scribbled a message to his mechanic which said, simply, "Kniesi, make this."

Today an engineering team can consist of hundreds of engineers and fabricators. Intimacy has dissolved. The things we make are much more complicated, more accurately made, and made in greater numbers. The machinery for the making has become more elaborate, and it takes more skill to use. Both the engineers and the fabricators are specialized to the degree that neither understands the other too well. The engineers devote themselves to research and development, to the generation of concepts in the shaping of materials and forces to achieve some given objective. They deal in the theories of natural law, in the functional limitations of materials, and in the ingenuity with which they can juggle and join the two, to conceive a product.

The fabricator is also ingenious. But his knowledge is of the machinery with which things can be made. His job in life is to determine the best and fastest and cheapest methods and facilities which can be used. He devotes himself exclusively to this, and he will avoid design. He quite rightly expects to have this supplied him —every bit of it.

The engineer deals in concepts and the fabricator deals in dimensions. It would be wasteful to expect hard

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Editor's Note: This article is based on a talk given by the author at the Educator's Seminar, Design and Drafting Council of Delaware Valley, at Temple and Pennsylvania Universities in February, 1959.

and fast, black and white, definition from the engineer and yet without it the fabricator cannot, and will not, make. Here we have the crux of the problem. An inadequate message from designer to fabricator will result in one of two things. The part will be made inadequately, or the message will be rejected right back to the designer. The latter, more than likely, along with caustic comments.

The engineer creates ideas. The fabricator makes things. The draftsman is the catalyst which joins them. He is the communication medium. Let me repeat this. The draftsman is the medium. To him falls the full responsibility for an interpretation and exposition which cannot be less than totally correct and clear. The ease with which he achieves this interpretation will determine just how little he will hold back the engineer, and the skill with which he makes the exposition will determine just how well he will facilitate the fabricator's work.

The Draftsman

The combination of responsibilities—truth, clarity, and technical contribution, promptly rendered—which the draftsman is expected to shoulder is heavy. To be successful, he needs to be a heavy man.

To you teachers he is a youngster who, under your tutelage, has acquired a degree of manual dexterity in delineation, an understanding of third angle projection and a small grasp of mechanics. When he enters industry he has barely begun to scratch the surface of his needed learning. As he grows, he becomes a creature of both kind and level. He generally becomes a specialist, acquires the skills and understanding of his particular industry. Now, in each group these men are classified by talent level and responsibility. At the very top there are Designers, sometimes called Junior Engineers. Below them are Design Draftsmen, sometimes called Layout Draftsmen. And below them are the Detailers.

The Designer is usually a veteran of many years and possesses extensive practical experience, is capable of applying the broad aspects of engineering science in developing design criteria, and knows quite a bit about fabrication techniques and processes. Given an objective he can—more or less independently—establish a solution by himself. He may do complex layouts or merely design sketches. He may perform analyses and studies both for or with his engineer. His determinations are passed down and parceled out to one or more layout draftsman for elaboration, and he may be expected to supervise, control, and guide this work.

The Layout Draftsman makes preliminary or development layouts and final layouts. He will provide needed mathematical calculations, establish proportions, weights, finishes and materials, and tolerances. He is capable of using the engineering information supplied to him in the form of sketches, notes, or verbal direction, from either the Engineer or Designer to develop a comprehensive design layout. This layout will be suitable for the preparation of details by Detailers, and the Layout Draftsman can be expected to oversee and be responsible for the Detailer's efforts.

The Detailer makes the documents which actually go to the fabricator. He makes drawings, and assemblies, suitable for translation into finished parts and products by the fabricator. This Detailer takes his information from layouts, sketches, and other instructions. He is often expected to supply minor dimensions, tolerances, and specifications. His is the final responsibility for producing a picture—part by part—which is complete, accurate, and understandable.

To indicate clearly the relative position of these men to your graduates I will tell you that, in our organization, we have three grades of detailers. Grade A, I have just described to you. Grade B is a less mature individual who is competent in delineation but has little or no technical knowledge or responsibility. Grade C is a trainee from whom not much is expected beyond a willingness to learn. To us the Grade C draftsman is your graduate. But only if he appears to have the potential for becoming, some day, not just a Grade A Detailer, but a Designer.

This may sound as if we want all Chiefs, and no Indians. Why should we expect every candidate who enters this field to be potentially capable of reaching the top if he is to enter it at all? It would be silly, if top slots were in short supply. The truth is that our years of shortage have created ample room at all levels. Including the top, which often becomes a jumping off place for other, parallel or higher, responsibilities in the engineering and related fields.

Industry needs good technical men in many categories and is constantly taking the cream from the drawing room. The three levels I have described to you, far from being static, are in a continuous state of upward progression. Most Chief Draftsmen are regularly bedeviled by the unhappy alternative of either delaying deserved promotions, or being left with inadequate manpower. Your boy, if competent, reaches Detailer A level, and a five thousand dollar income, in about a year. He can probably make one of the Layout levels in another year or two to earn from five to seven thousand. If blessed with ambition and talent he can reach the Designer status in five to seven years and go up to nine thousand, and sometimes more. If he started as a high school graduate and is willing, most companies will pay for about three-quarters of an accredited engineering education on the side. If he gets his degree, and quite often even if he doesn't, he can move directly into engineering.

Too often young men have completed the study of drafting without parallel training in the fields of math, science, and English. Please note that I included English. Lacking a background in the technical fields and facility in expression, such an individual will be skilled in the art of delineation only. He becomes an adequate Detailer with, like a mule, no hope of intellectual progeny. Industry has room for only a limited number of such people. As the Designers are siphoned off for other work, the Layout men must be the replacement. Then the Layout men need to be replaced. The Detailer who is considered to be terminal cannot provide the next replacement echelon, and he is now in everybody's way.

I have shown you that the draftsman is a career transient, who will carry considerable responsibility on his upward climb. It follows then that he needs to be capable of accepting these responsibilities. And, to get back to them, he positively must be able to understand and to articulately con-

vey information.

I am sure you have all seen, at one time or another, pictures of engineers and draftsmen holding a round-the-drafting-table conference. Such conferences are an integral and vital part of the day to day work. An inarticulate draftsman will not contribute much to such a conference. This communication ability in the draftsman works both ways. In the lower levels he needs often to ask instructions or to explain problems. As his level grows and his ideas become valuable he needs to be able to effectively explain himself and to sell his thinking. The ability to use words is more important than the ability to make pretty lettering and almost as important as the ability to intelligently depict.

Another important requirement we make upon the draftsman is speed. If a man earns five dollars an hour and it takes him one hour to complete an assignment he has cost five dollars. If he takes two hours to complete the same assignment, the effort costs ten dollars. Since a business organization is predicated on the assumption that it will make profits it is reasonable to expect that the value of every operation will be measured by the time it takes, or the money it costs.

While the draftsman is needed to stand between the engineer and the fabricator, the fact is nevertheless inescapable that this draftsman is also a time barrier between the two. For as long as he takes to prepare his message, so long is the message delayed in reaching the fabricator. So much later will it be that the parts will be made and the finished item moved off the shipping dock. To this extent the draftsman will always be slightly unpopular, and no rationalization about how important is his work will change this. To industrial management he is, and must be, an expensive overhead and time loss. If this same draftsman is a pokey, he will really be unpopular. Now, there is nothing that teachers can do about training draftsmen to be fast. Speed is a compound of skill and knowledge and the resultant confidence. The student will be expected to acquire all three after he leaves you.

In the very early stages of his career he is what he has always been —a pictorial communicator between the engineer and the fabricator, a sort of engineering secretary who listens to technical dictation and prepares a missive. Past this point he becomes something different. He has moved into the bottom echelon of a series of engineering levels and commences to move upward. He has been admitted into the engineering team—and is expected to integrate. At the higher levels the difference between the assignment of duties to the draftsman, and to the engineer becomes neither great nor clear. The engineer, formally schooled, has a broad concept of fundamentals and is trained in the application of theory to problems. No limitations exist to prevent the able draftsman from developing equal skills and, in the permissive and encouraging atmosphere in industry, a good draftsman can become an engineer. Many do so.

Today the drawing room has become one of industry's handiest manpower pools for the filling of subprofessional and leadership jobs, and the standards of selection of the draftsman candidate needs somehow to be re-orientated to recognize this new fact of life.

Drafting Practices

We have established that drafting as a communication medium really means that both the draftsman and his drawings are equal parts of the communication. So far we have talked about the draftsman. Now let's take a brief look at some of our drafting practices.

To begin with it appears that most schools still have the students working on a buff cardstock. Twenty years ago in order to achieve a decent blueprint, a final drawing needed to have the most opaque line on the most transparent paper. Anything less would produce a print whose contrast was poor and reading difficult. The procedure used was the actual drawing with pencil on cardstock and the subsequent tracing—in ink—onto tracing cloth by a low-level tracer. Today the technique, the tracer, and the use of cardstock is extinct. Contemporary blueprinting equipment produces excellent contrast and readability from pencil on vellum drawings, and this is what we use.

The student comes to us with a moderate skill in working on cardstock, which we don't know what to do with, and no training at all in the use of vellum. Furthermore, since cardstock bruises badly with erasures, the student is inhibited against making them. Industry practice requires extensive erasure and correction. The student's inbuilt fear gives us an immediate retraining problem. It should be the other way around. We badly want him trained and skillful in making corrections.

Ink, as such, needs a little attention. Some ink line work and some ink handlettering is still done in special applications. These are comparatively minor in volume. The training time currently applied here could probably be used to better advantage elsewhere. Ink lettering is done, but with mechanical lettering guides. Student training in their use would be enthusiastically welcomed.

Textbooks — and standards manuals—contain a sizable number of line weights to be used in differing drawing applications. For the most part industry ignores this convention and uses exactly two: thick and thin. Practical experience has shown that the draftsman working in pencil spends too much time in trying to hold these weights, that they are generally not too easy to distinguish one from another on a drawing, and that they contribute little or nothing to the clarity or effectiveness of the message.

While we are speaking of line conventions let's look at the one which, in sectioning, specifies that the lines shall be encoded to indicate different materials. In the first place a material designation on an assembly drawing is an improper practice. The people who do the assembly have no interest in, or control of, the material choice. They assemble finished parts. Material specifications belong on the detail drawing only. Here a designation which specifies steel, for instance, is worthless. The fabricator needs to know which one of 50 varieties of steel, and the line symbol convention will not tell him this. We do, in fact, crossline sections on an assembly. We do it to distinguish one part from another. But this sectioning has absolutely no significance.

Another interesting practice is the usage of drawing callouts which specify—explicitly or by implication—the method of fabrication. If the draftsman shows a hole and puts a callout on it which says "One-quarter

(*Continued on page* 28)

Engineering Illustration Today

A definition of the craft, and the craftsman, for an industrial society which is demanding maximum speed and clarity in communication

by Roland C. Alexander

The use of pictures to communicate ideas is nearly as old as mankind. We are all familiar with ancient picture writings, the oriental ideographs, Egyptian hieroglyphics and the pictographs of the American Indian. Languages have progressed thru idea symbols, word symbols, phonetic symbols and abstract combinations accompanying the general development of our culture and the sophistication of our society. But just as new products demand new tools, significant changes in our industrial society have demanded improved communications. Outstanding among these changes have been specialization of effort, compression of time and decentralization of facilities.

Specialization of effort has naturally been accompanied by specialized training and narrow spans of experience. Since understanding depends upon experience, communications must appeal to some common area of experience among specialists in order to achieve general understanding. This calls for a common language.

The compression of time has placed great new demands on the communications field. Once, the various manufacturing responsibilities were able to operate in orderly progression, each passing its work along to the next. We now find product design, tool design, plant layout, processing, production planning and the rest of them, all going ahead simultaneously. This calls for elasticity where messages can be aimed, tailored and timed.

Multi-plant operations have injected distance into the problem and removed the personal contacts of the old days. The foreman can no longer step across the aisle to lean over the designer's shoulder: today's communications must stand on their own.

The old idea (perhaps sufficient unto its times) that the man capable of making an engineering decision was also the best-qualified person to transmit that decision, is becoming recognized not only as archaic but highly inefficient.

Today, decisions become information that is transmitted three-dimensionally, that is, vertically, horizontally and in all directions. To the receiver, such information arrives from many directions and at various times, in various forms. It becomes the raw material for his processing and results in further decisions to be transmitted to other receivers, and so the vine of data expands and intertwines into a complex organism.

Not until the needs of the receivers are understood to be paramount to the whims or ingrained systems of the senders, can those needs be analyzed and satisfied through up-to-date, functional communications. The designer's work paper is no longer an acceptable message form for all receivers. Even though it is obvious that the orthographic drawing, constituting a record of design decisions, is still vital to many functions, it is equally obvious that to many others, it falls far short of doing the knd of communicating job that modern methods demand.

What is Engineering Illustration?

Engineering Illustration is a communications concept. More than a message form, it actually constitutes a 'new look' in the area of industrial communications. Stated briefly, it is a method of transmitting engineering information in the universal language of pictures, of representing three dimensional objects on two dimensional planes.

It is similar to orthographic or mechanical drawings in that it is fundamentally graphic, using only as much text or written matter as is necessary to complete the message. It is different in that it may be understood by people with little training in reading drawings. This is becoming more important every day because of the general de-emphasis of graphics in the training of professional engineers and the increased participation and 'need to know' of non-engineering personnel. It is different in that an illustration allows for comprehension in depth whereas in orthographics, one frequently must understand nearly everything in order to understand anything. It is flexible and can be tailored to fit the subject matter and the needs of the receiver, while orthographic drawing is more stereotyped and confining. It is a familiar, not a foreign, language in that it is used by all of us every day. Our greatest source of knowledge and understanding is through seeing and most of our seeing an therefore most of our thinking about material things

is in the form of three dimensional pictures. It is a common language.

Any list of the uses of Engineering Illustration would be impossibly long and probably obsolete before one could reach the end of it. There are, however, certain areas of responsibility where it is widely applied.

In design: for proposals, preliminary design and orientation. Here it is used primarily to take ideas out of the thinking and talking stage and put them into a realistic form so that all concerned can immediately visualize and understand, and for liaison between the various areas of design.

In transportation: for parts densification, predetermination of loading methods, instructions for shipping, handling and storage.

In sales: to insure that the unique features of a product are technically correct in presentation, and for installation and operating instructions.

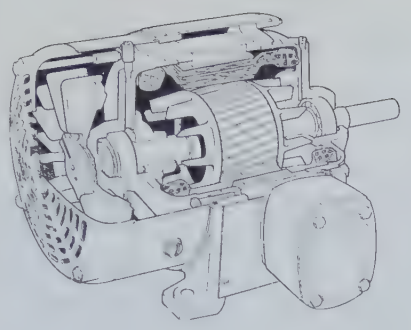
In service: for service and maintenance manuals, parts and accessory books, data books, and for personnel training aids.

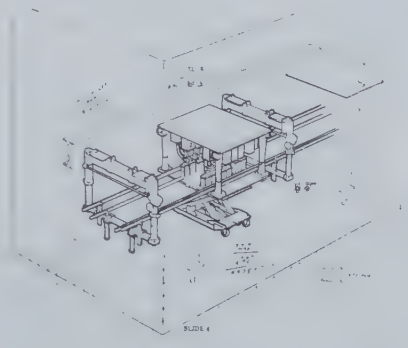
In production: for assembly instruction manuals, methods standards, quality control, inspection, operation description sheets, material handling, tool and equipment specifications, plant layouts, conference drawings and slides and in general, all phases of production control.

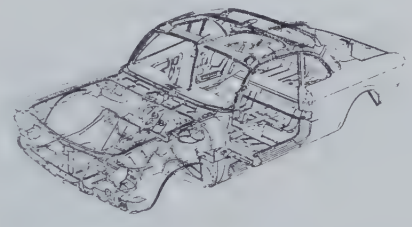
How is Engineering Illustration Accomplished?

As stated, the use of pictures in communications is not new, only the concept and scope of their application to industry are new. Nor are the basic tools of engineering illustration new. The illustrator uses perspective axonometric projections, oblique projections and orthographics and has not invented any dramatically new system of geometry or drawing. He mostly uses the same implements that draftsmen and artists have always used. At the same time he has developed, and is developing every day, methods and techniques, short cuts and tricks, styles and treatments and specialized equipment that were unheard of a few years ago. The novelty of his accomplishment, though, lies in the extent of perfection, the emphasis, the intensive continuation and expansion of known precepts.

Put most simply, the qualified illustrator of today must be able to read blueprints and to draw. Actually, he







Editor's Note: This article is adapted from a slide program presented for the Society of Engineering Illustrators, Inc., by the author, its past president, to the 8th annual Institute for Drafting Teachers at the University of Michigan, April 9, 1960.

is a highly skilled technician who can read prints of all kinds; electrical, hydraulic, mechanical, sheetmetal, structural, etc., from all fields like automotive, aircraft, ordnance, architectural, automation and packaging. And, because a great many engineering decisions are not to be found on blueprints, he is accustomed to understanding and drawing from written or verbal descriptions.

He can draw accurately freehand or use any projection system including isometric, dimetric, trimetric or oblique or any system of one, two or three point perspective and he is also capable in orthographic projection. He is skilled in rendering, particularly in that type of shading which shows form and texture in order to describe an object or to distinguish one part from another. He is familiar with printing processes and can vary his technique to insure good reproduction. He is a new kind of man and a good one, making definite contributions to industrial efficiency and, thereby, to society in general.

The long-range future is another matter. The very trends that have demanded the growth of engineering illustration to its present state will make even greater demands. Engineers will be called upon to operate more and more like scientists in the realm of ideas, of analysis and decision, of solving problems through creative processes. These engineers will be trained in drawing skills only to the extent that enables them to make such sketches or orthographic layouts as are necessary to their thinking or for the orientation of associates. They will be familiar with all kinds of drawings from the reading standpoint. They will know something about how, where, and when to use drawings but there will be a need for someone else to communicate their ideas and decisions.

Someone else will have to decide what to communicate to whom at what time and in what form. This goes far beyond the ability of today's average skilled illustrator who can read prints and make drawings. This will call for the professional approach of analysis, decision based on knowledge, and training resulting from extensive intellectual preparation. This will require an understanding of industry involving products, materials, processes, and engineering functions. It will take a thorough knowledge of message forms and skill in their preparation, whether visual or otherwise. It will call for the services of an Industrial Communication Engineer, educated as a professional, functioning and accepted as an equal with other engineers.

The Author

Roland C. Alexander, vice president and general manager of Technical Illustrators, Inc., Warren, Michigan, is past president of the Society of Engineering Illustrators, Inc.

Versatility in Reproduction

Hamilton Standard, adopting a new offset system, finds measurable savings and broadened, quality performance

THE general office supervisor of Hamilton Standard Division of United Aircraft Corp., Windsor Locks, Conn., received recently what could have been a rather unsettling assignment: "Duplicate a 100-page engineering proposal of great importance to the company, and get 25 copies in Boston by 4:30 p.m." The time was then 12:30 p.m.; an airplane was standing by.

His staff swung smoothly into action. One hundred photo-offset masters were ready for the department's four presses in less than an hour. In another hour, 2500 pages had rolled off the presses, been collated into 25 copies, and rushed to the plane. It took off at 2:30, in plenty of time to meet the Boston deadline.

"Before January," says Lawrence M. Baldwin, general office supervisor, "such an assignment would have been virtually impossible to fulfill."

Even with an all-out effort on the part of their duplicating unit, the plates would have taken as long to reach the presses as they did to reach the plane in this case.

System Change

IT WAS in January that Hamilton Standard, one of the nation's leading aircraft propeller and jet equipment manufacturers, decided to make a change in its system of reproducing hundreds of forms, memos, drawings, proposals and other documents that pass through the department every week.

Reason? "We were virtually limited to line work with our previous systems," explains Baldwin. "If we had any solids or bold headings in the copy to be reproduced, or if we had to copy half-tones, we had to go to the photo lab to have negatives made from which photographic metal plates could be prepared.

"In addition, well over 50 per cent of our work involves paste-ups. With our previous system, this often required up to 10 minutes a plate cleaning unwanted shadow background from the paper plate.

"As a result, with one operator, we always had about a two-day backlog of work."

To increase efficiency Baldwin decided to install a new system designed to produce inexpensive paper masters for offset reproduction. A master of the original copy—reduced, enlarged or same size—is produced photographically using a standard copying camera and desk-top Ektalith Loader-Processor Unit.

Three simple steps are needed for each master—1.) the original is exposed to a sheet of Ektalith transfer paper, 2.) the paper is processed, and 3.) the photo image transferred to the paper master. The entire operation takes less than two minutes, and can be carried out in normal roomlight.

The system offers wide versatility, permitting the copying of practically any printed, typed, written or drawn original, in virtually any color. Masters require little or no cleanup time, and

*The system adopted, called the Ektalith method, was introduced recently by Eastman Kodak Company.

HAMILTON STANDARD operator Mary C. Cooley positions engineering drawings on the Ektalith copying board.

TRANSFER paper in holder is exposed to drawing through copying camera.

PROCESSED paper is brought into contact with paper master, then stripped away leaving photo-image to be duplicated.

can be easily corrected or changed prior to running.

As a result of the installation of the system at Hamilton Standard, now one operator is able to turn out all necessary plates—an average of 200—in half a day's time. This allows utilization of the operator's services on one of the department's offset presses during the afternoon hours.

Estimated dollars and cents savings? Approximately $30 a day in materials, labor and overhead. In addition, the department has reduced its use of photographic metal plates approximately 75 per cent, a saving of $1.15 a plate or roughly $500 a year. Total dividend: roughly $8,000 a year.

Two specific examples help to point out how the new system is performing at Hamilton Standard:

A time-consuming step in the preparation of the many 5x8-inch forms used throughout the company has been eliminated. These forms, most of them designed on the drawing board, previously had to be drawn twice and headings and type set on a special typewriter. Duplicate original forms were necessary so that they could be photographed simultaneously to make a plate for running "two-up."

Now original copy is photographed in one position, transferred to the plate; then the copy is re-positioned in the camera frame, re-photographed and transferred to the same plate.

Time saved: up to an hour on the drawing board, another hour on the typewriter. Since 5x8 forms are produced approximately six times a week, the department saves 24 hours a month on this one application alone.

Another of the more formidable tasks faced by the duplicating unit is the printing of the company's telephone directory, a comprehensive listing changed three times a year. The original copy—a visible panel set-up containing overlapping interchangeable cards with a typed name and phone number held on a metal panel—is reduced roughly 35 per cent to a 6x9-inch format. To eliminate shadow line background where the cards overlapped, the Duplicating Unit had previously been forced to use pre-sensitized metal plates for the job, a costly and time-consuming process which took roughly two to three working days. Now the 32 plates required for the directory can be made in about three hours.

Hamilton Standard's Duplicating

Unit prints all the company's 8½x11-inch and 8½x14-inch single internal forms (excluding snap out and continuous forms) and a wide variety of memos, sales brochures, technical catalogs, parts lists, engineering proposals and manuals on drafting, materials standards, metallurgy and inspection procedures.

"One operator can turn out roughly a plate a minute," according to Baldwin. "In emergencies, using one person on the copy camera and one on the Ektalith processor, we can get a plate in 30 seconds."

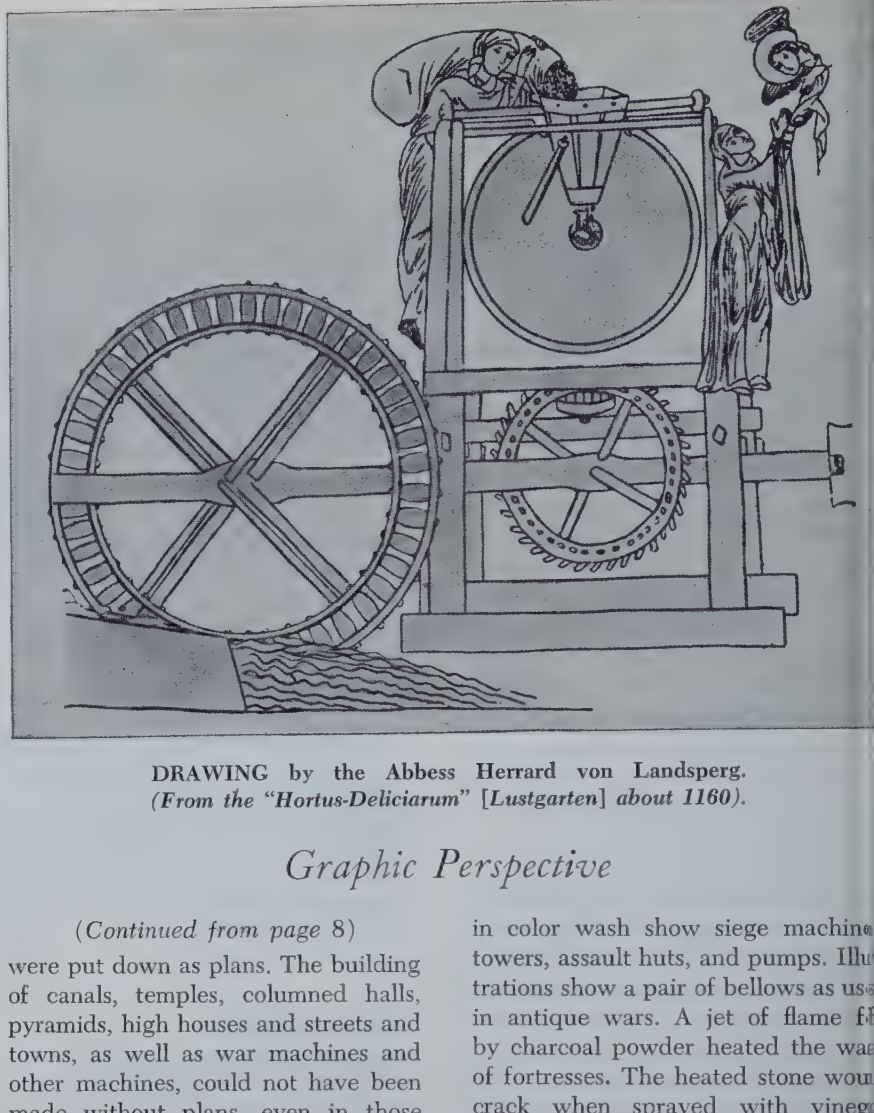
This contrasts with the previous method which, with one operator, permitted a maximum output of approximately 120 plates daily.

About two-thirds of the Duplicating Unit's work involves one-to-one reproduction; the other third, various reductions in size of original engineering drawings, charts, and other documents. On engineering proposals, for example, specification sheets are reduced 25 per cent, drawings 50 per cent.

Runs vary from 25 copies of a 50-60 page engineering proposal to thousands of copies of forms or internal communications to employees. Although the top requirement to date from an Ektalith-made master has been 9,000 copies of an internal form, the quality of the last copy was as good as the first, according to Baldwin. Moreover according to the group's most experienced printer, the master would have been good for another 10,000 copies. It would stay on the plate, in other words, until the plate fell apart.

Although very little of the Unit's work involves direct image plates—"working with copy, you're more flexible, with direct image plates you're not," says Baldwin—one interesting application involves the use of preprinted direct image plates for office forms, produced from Ektalith-made plates, which are circulated to key personnel for signatures. The forms contain common information. Variable information is added to the master enroute with reproducing pencils. All the information is thereby easily combined for the final run.

It's this versatility, plus speed, plus the quality of the finished copy that has characterized the performance of this new photo copying system of offset plate-making at Hamilton Standard.



DRAWING by the Abbess Herrard von Landsperg. ***(From the "Hortus-Deliciarum" [Lustgarten] about 1160).***

Graphic Perspective

(*Continued from page* 8)

were put down as plans. The building of canals, temples, columned halls, pyramids, high houses and streets and towns, as well as war machines and other machines, could not have been made without plans, even in those times.

Sextus Julius Frontus, curator of the great Roman water ducts, said in his book, *De Aquaductibus*;

> We have also had sketches made of the foundations of the ducts, from which can be seen where dales and rivers are situated over which we have built, and where concaves (built over precipices) will need constant supervision and maintenance. This has the advantage that we have the subject in front of us and can make decisions just as if we were on the spot.

The most significant manuscript of antiquity with technical representations was by Appollodoros of Damascus. He was employed as Technician by the Emperors Trajan and Hadrian in Rome, but fell into disfavor because of his free criticism of new buildings put up by Hadrian. He was executed in A.D. 129 in Rome. About two years before, while living in exile, he wrote *Poliorketica,* a work on the techniques of warfare. The library of the Vatican possesses a copy dating from the 11th century. The drawings in color wash show siege machine towers, assault huts, and pumps. Illustrations show a pair of bellows as used in antique wars. A jet of flame fed by charcoal powder heated the wall of fortresses. The heated stone would crack when sprayed with vinegar which penetrated deep into the pores.

An illustrated manuscript consisting of 324 pages of vellum, contains 6[illegible] interesting drawings (*Hortus deliciarum*). It had been composed by the Abbess Herrad of Landsperg in the cloister Odilienberg (Alsace) for her pupils. This work was an instructive collection of knowledge. It was burned when Strassborg came under fire in 1870. The only remains are a few drawings that had been copied by scholars. Among these is a large illustration of a wine press and an undershot mill. The projection is peculiar. The most important pieces are drawn on a plane with the spokes of the waterwheel following this distortion.

Technical sciences as well as technical drawings lacked all system. Everyone used his own conception. Machines were almost invariably drawn three-dimensionally, but only the vital details were put in. The first really clear intersected illustration developed in architectural drawing

(*To be continued*)

New Products

Lightweight Lead-Holder

An improved drawing pencil holder, the Microtomic Lead-Holder No. 514, has been announced by the Eberhard Faber Pen & Pencil Co., Inc., Crestwood, Wilkes-Barre, Pa. This lightweight holder is carefully balanced. A bronze clutch and strong spring keep the lead from twisting or slipping. In addition, it has a changeable degree indicator, which permits the draftsman to change to any of 12 degrees of lead hardness from B to 9H, by loosening the top cap and turning the hood.

Heavy Copy Paper

Heavy, bond-like copy paper, for use on any Thermo-Fax copying machine, has been announced by Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn. Slightly higher in price than regular copy paper, Type 433 paper is designed for prestige applications, or where a more durable white copy paper is needed. The new paper is available in standard sizes, as well as special sizes to order.

Tracing Paper Pad

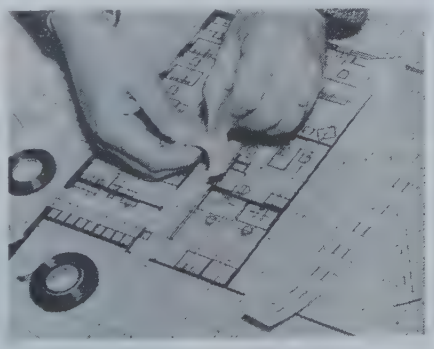
Tracing pads — plain, or with a variety of fade-out grids—have been introduced by the A. Lietz Co., 840 Post St., San Francisco 9, Calif. Called Fast-Draw, these tracing paper pads are available in 8½-by-11-, or 12-by-18-inch sizes. They are modestly priced, and are said to possess a superior drawing surface with good erasing qualities and rapid print speed.

Overhead Projector

For teaching and for professional use, a new 750-watt overhead projector has been introduced by the Audio Visual Dept., Ozalid Div., General Aniline and Film Corp., 46 Corliss La., Johnson City, N. Y. According to the manufacturer, the new projector gives more light with less heat than other 1,000-watt projectors. Equipped with a precise Fresnel lens, the unit permits projection of large slides; it is mechanically simple. On-the-spot materials may be presented on transparencies with a grease pencil. Lamp is accessible for removal, and the head post is detachable for portability.

Drawing Set

Neatly packed equipment that is portable and professional has been introduced by The C-Thru Ruler Co., 827 Windsor St., Hartford, Conn. Included in the set are a 13 by 19 inch basswood drawing board, T-square, protractor, french curve, 30/60/90 triangle, 45/90 triangle, architects' scale, slide rule, bow compass, architects' scalemaster, lettering guide, erasing shield and eraser, and a leadholder.



Pressure-Sensitive Materials

The new line of AG pressure-sensitive drafting materials manufactured by Applied Graphics Corp., is now being distributed by the A. Lietz Co., 840 Post St., San Francisco 9, Calif. Over 2,000 items are available, including templates, grid sheets, die-cast symbols, numbers, letters, and printed-circuit symbols. These AG drafting materials are said to be precisely printed on shrink-resistant, transparent bases.

Protractor-Triangle

Adjustable protractor-triangles, fabricated from a fluorescent acrylic material, reflect an orange light from all edges. Offered by Alvin & Co., Inc., 611 Palisado Ave., Windsor, Conn., these shatter-resistant right triangles may also be used to draw accurate angles from 0 to 90°. The protractor element has two rows of die-sunk graduations. Angles may be set to graduations of ½°. The fulcrum point has an aluminum screw post, and the adjustment is held to any angle set by a knurled screw.

Desk-Top Collator

A portable, electric collator that can automatically deliver as many as 1,800 collated sets per hour has been introduced by General Binding Corp., Northbrook, Ill. Produced by Collamatic Corp. (now an affiliate of GBC at Wayne, N. J.), the electric collator completes GBC's integrated paperwork systems, making it possible to have a completely bound book of material about 15 seconds after the pages have been run off the duplicating machine.

Lead Dispenser

All 17 degrees of drawing pencil lead produced by Koh-I-Noor Pencil Co., Bloomsbury, N. J., now come packed in a new Ejectomatic Lead Dispenser. Introduced as a convenience for the draftsman, the lead dispenser feeds lead automatically to the holder without the need of handling the lead.

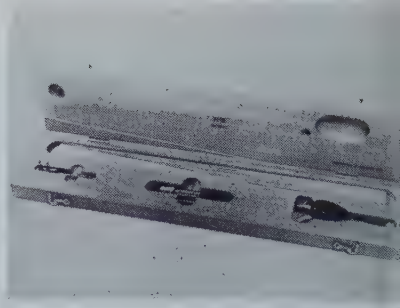
New Products

Adjustable Lamps

Lamps with flexible stems – directional arm with 24-inch reach and adjustment knobs, or an all-direction gooseneck stem–are being produced by Swing-O-Lite, 13 Moonachie Rd., Hackensack, N. J., for drafting, assembly-line or bench work. These Craftsman Lamps (Model IM Directional Arm, and Model IG Gooseneck Stem) use economical 75-watt incandescent bulbs and a ventilated shade to provide bright, direct light.

Drafting Machine

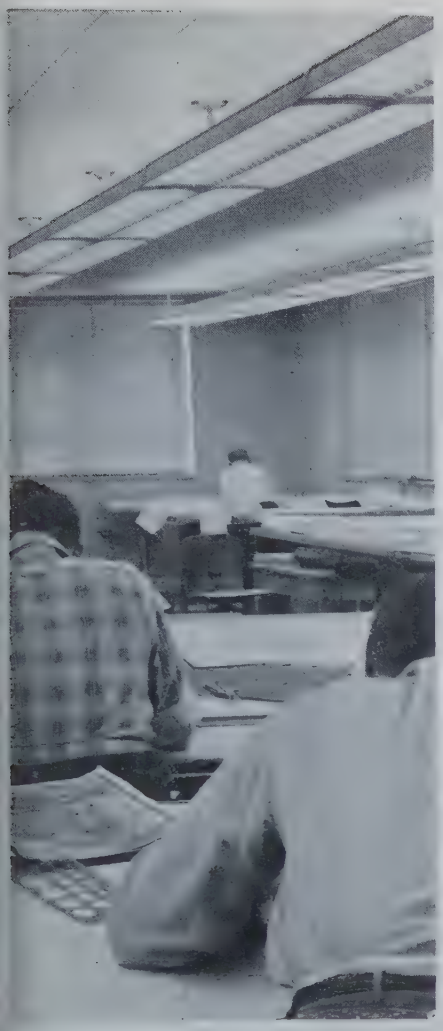
Tract-type drafting machine for lofting, layout and big-board drafting has been introduced by Glideline Corp., 233-D North Franklin St., Waynesboro, Pa. Called the Glideline 80, the new machine has been designed with a minimum number of moving parts in order to eliminate cumulative errors due to wear and tolerance. The unit is said to offer finger-tip control everywhere on the board, in vertical or horizontal position, without rollers riding on the working surface. Full-length horizontal and vertical parallel lines can be drawn with one motion. The Glideline 80 is available in standard models for board sizes from 5′ by 8′ through 8′ by 30′; the company will quote custom sizes on request.



Lettering Set

An economy-priced lettering s combining both upper and lower-c letters, and an adjustable scriber slant lettering has been introduced Keuffel & Esser Co., Third and Ada Sts., Hoboken, N. J. Designated No. 8935 Doric Lettering Set, the o fit has the complete lower-case alp bet in three sizes (.10 inch, .14 i and .24 inch), in addition to standard capital letters, symbols a numerals. Included in the set are template, adjustable scriber, two tering pens, lead holder, lettering cartridge, and a plastic straight-ed

(For additional information regarding the new products described here, contact the manufacturer directly. Complete addresses are included.)



LINDEN TOOL & MFG. CO., Dayton, Ohio—Suspended lighting fixtures with four slimline fluorescent lamps in each are located above the sides of the drafting boards, to minimize shadows and reflections. About 200 footcandles of illumination are maintained in service.

AKROMOLD CORPORATION, Akron, Ohio—This installation employs all metal lighting units which accommodate four high output fluorescent lamps each, to supply about 225 footcandles. The luminaires provide 45° shielding both crosswise and lengthwise.

Light: A Sequel

Less dark at the top of the board

EXCELLENT examples of drafting room lighting at 200 footcandles and above are shown in the illustrations with this sequel to the Fisher-Flynn article in our September issue. Mr. W. S. Fisher, engineer specialist for office lighting at General Electric's Lamp Division headquarters at Nela Park, has made these examples available to us.

In our editorial note prefacing the integrated lighting - air conditioning concept, which Messers. Fisher and Flynn presented in their article, we indicated that G-E experts did not know of any drafting room installation at 200 footcandles. What we meant to say was that the integrated system idea was so new that examples of its application at advanced levels had not been reported. That was the situation last spring when the article was received. Since then things have changed.

There are not only fine examples of drafting rooms with 200 footcandle installations, but we learn from Mr. Fisher that several thousand square feet of integrated lighting and air conditioning will be in service before the end of the year, a confirmation of the cost-saving advantage of the new technique. To Mr. Fisher and his associate Mr. Flynn, G. E. staff architect at Nela Park, the quick response to their progressive ideas is a great satisfaction. GRAPHIC SCIENCE takes this opportunity to note their success in bringing advanced lighting to drafting rooms.

New Products

Photocopy Negative

New negative material, said to combine camera and transfer copying techniques, has been introduced by Ampto, Inc., Subs. of Anken Chemical & Film Corp., Newton, N. J. Called Ampto Projection Transfer Negative, the new material is a diffusion transfer negative of camera speed, designed to eliminate time-consuming, three-tray development. It can be processed in a single solution in any standard diffusion transfer processor. Copies can be made same-size, reduced, or enlarged.

Roll Film Viewer

Table-top film viewer that accepts 9½-inch roll film in lengths to more than 390 feet, is offered by Kargl Co., P. O. Box 6647, San Antonio, Tex. The fluorescent light source is diffused through opal glass to give even light distribution over the entire 12- by 16-inch surface. Auxiliary spool holders are available for 105mm, 5¼-inch, and 7-inch wide roll film.

Wash-Off Polyester Film

Drafting film that produces erasable ink-black lines from pencil originals, and permits ink or pencil-drawn additions, has been announced by Keuffel & Esser Co., Third and Adams Streets, Hoboken, N. J. Called Dupro Polyester Film—a combination of Herculene drafting film and Dupro emulsion coating—the material's ink acceptance is regarded by K & E as a major improvement over many drafting films which tend to make inked lines "feather." The new film is said to have high transparency for reproduction and long shelf-life expectancy without loss of wash-off characteristics. Using the Dupro reproduction as a "second original" saves time, according to K & E, since it eliminates the need for re-drawing those elements of the original which remain unchanged.

Drafting Machine

All important engineered features of their larger professional models are said to be incorporated in the Model 3300 Drafting Machine with 20-inch arms now being marketed by V. & E. Mfg. Co., 766 South Fair Oaks Ave., Pasadena, Calif. The 3300/20″ Drafter is a compact instrument, yet it covers a 34″ by 44″ drawing area. It has automatic indexing for positive settings at 15-degree intervals, or free rotation for setting at intermediate angles. Disc brakes aid in maintaining its position on a moderately inclined board, and ball joints within the elbow brackets permit the head to be lifted over objects on the board.

New Products

Draftsman's Stool

Utility stool for "standing-sitting" operations in the drafting room has been introduced by Stylex Seating Co., 911 Walnut St., Philadelphia 7, Pa. The new Model 2740L is a revolving unit, featuring a foam rubber cushioned contour seat, and a posture backrest. Seat height can be varied between 22 and 28 inches; a higher stool of the same design (Model 2740H) is also available. Base provides a comfortable footrest.

Opaquing Medium

An adhesive-backed, transparent film that is dimensionally stable, offers to draftsmen, engineers, architects, blueprinters, etc., an efficient means of masking, blocking or opaquing in the preparation of blueprints, photo negatives and positives, and artwork. Called Para-Paque, the material is a deep red film that completely blocks the pasage of light. It is manufactured by Para-Tone, Inc., P. O. Box 136, 512 W. Burlington Ave., La Grange, Ill. According to the manufacturer, Para-Paque has been tested on 150-watt blueprint and whiteprint machines, at speeds down to ½-foot-per-minute. The user lays on a sheet, cuts and peels it away. The adhesive-backed material will resist temperatures up to 250°F.

New Literature

Pointers on Dimensions and Tolerances, by Joseph de Feher, Consulting Engineer, Arlington, Va., has been published by the Small Business Administration, Washington 25, D. C., as No. 72 in their series of *Technical Aids for Small Manufacturers.* This *Aid* presents a review of the "why and how" of tolerancing; a bibliography of additional sources of tolerancing data is included. Copies of Aid No. 72 are available free from field offices and Washington headquarters of the Small Business Administration.

Precision Tools Catalog, describing an extensive line of cutting tools for graphic arts work, may be obtained from The Griffin Mfg. Co., Webster, N. Y. Stencil knives, pounce wheels, swivel knives, pin vises, compasses, marking pencils, pen and pencil holders, etc., are included. All tools are illustrated, and prices are listed.

Microfilm Engineering Drawing Systems, a booklet prepared by Recordak Corp., Subsidiary of Eastman Kodak Co., 415 Madison Ave., New York 17, N. Y. to familiarize engineering management personnel with 35mm microfilm systems, is available on request to the company. Actual samples of aperture cards with a variety of film types (original camera film, intermediate copy, release copy and diazo negative image copy) mounted thereon are included. Three programs for handling engineering drawings are suggested, illustrated with flow charts.

Translucent Parchment Information Folder, and a brochure containing sample sheets of Patapar Translucent Parchment for testing purposes, are available from Paterson Parchment Paper Co., Bristol, Pa. The folder given information on the material's use in Diazo-type copying machines, such as Bruning, Ozalid, etc.

Drafting Instrument Brochure, de scribing Draftette, a portable draf ing machine, may be requested fro David Miller & Associates, P.O. Bo 572, Beverly Hills, Calif. The illus trated brochure lists the differer sizes available, with or without port able boards. Write directly to th manufacturer for this brochure.

Photogrammetric Equipment Bro chure, describing mapping and repro duction equipment manufactured b Kargl Co., Inc., P. O. Box 6647, Sa Antonio 9, Texas, may be obtained b writing to the company.

Photographic Enlarger Brochur (584 USA XI 58), describing th Durst M 35 Precision Enlarger fo miniature and sub-miniature nega tives and for microfilming, may b requested from Durst (USA) Inc 770 Eleventh Ave., New York, N. Y A range of accessories for reducing distortion - correction, copying an photographing are also covere briefly.

(Copies of the literature reviewed can be obtained directly from the manufacturer or publisher. Complete addresses are included.)

The Book Shelf

PROBLEMS IN GRAPHICAL ANALYSIS, by Percy H. Hill, McGraw-Hill Book Company, Inc., New York, 1959 ($5.50)

THE FUNDAMENTAL assumption in Professor Percy H. Hill's new set of problems is that engineering graphics is the first of the engineering sciences. As a science, it should be a vehicle for analysis and synthesis. Hill has adhered determinedly to his objective and now presents a set of problems about which no one can be neutral.

This is not a conservative set of assignments in the sense that an experienced draftsman could pick it up and breeze through it solely on the basis of his draftsmanship. On the contrary, he would have to resort to his knowledge of descriptive geometry—or to a textbook on descriptive geometry; but he would need more, too. He would need ingenuity, patience, and perhaps his intuition. In fact, he would probably need a teacher and a good teacher, at that. If this is so, you can readily believe that such a book, designed for freshman engineering students, is quite likely to stir up some controversy.

Hill's problems reflect what I believe is the most recent thinking of the younger group of teachers of graphics, that is, of engineering drawing and descriptive geometry. These two subjects, according to carefully considered assertions, should be "integrated"; they are not separable. And indeed they are not, for descriptive geometry is the theory of technical drawing. The great argument is on the meaning of integration and how to implement it.

Actually there can never be a completely satisfactory answer; it must always be a compromise. Each author answers the question of integration and its implementation in a way dictated by his own education and experience. Each teacher accepts or rejects the answer according to his own background. Professor Hill's answers, in the form of *Problems in Graphical Analysis*, will delight many progressive teachers; I have no doubt of it. And many equally progressive teachers will, I believe, disagree. As I have already said, there will be no neutrals.

The set consists of sixty-five sheets, each 11 by 17 inches in size, unbound and packaged in an envelope for carrying and storing. Among the topics are: fundamental concepts; orthographic projection; auxiliary views; spherical triangles; sections; dimensioning; estimating of quantities; developments; isometric, oblique, and perspective pictorials; threads; highway topography; warped surfaces; graphical calculus; nomography; vector analysis.

If you think you might be interested in adopting Hill's problems for use in your classes; you may write to the publisher and ask for an examination copy.

I. W.

(*Continued from page 15*)

inch Drill" he is, in effect, telling the fabricator that the hole is to be accomplished with a drill. This philosophy carried logically to other, and more complex, callouts is very apt to result in requiring an improper or an injudicious choice of fabrication facility. In other cases it may result in overloading—in the shop—one facility while another equally effective facility stand idle. Shop superintendents have been known to speak up very emphatically on this score.

Common industrial practice prohibits the usage of any directive on a drawing which tells the fabricator how he is to do his work. A drawing is made to indicate the desired end-result but not the means of achieving it. Thus the "One-quarter inch Drill" callout now reads "One-quarter inch Diameter." The draftsman is supposed to specify what is wanted and we leave the decision on how to make it to the fabricator. If a machinist thinks he can create the hole by biting it out with his teeth he is at liberty to do so.

Let's consider the lowly template. It takes about four minutes to lay out and draw a hex nut properly. If a drawing needs 50 such it will take 200 minutes to draw them. The same nut can be drawn with the template in about half a minute. We have hole templates, hex nut templates, radii templates, specialty component templates. Most are commercially available. In many cases we make our own. They are tremendous time savers and their use will generally improve the quality of the drawing. The work is done faster and easier and, you will be interested to know, requires considerably less skill.

I have seen student drawings of gears. A difficult subject and a time-consuming one. Industrial drawings of gears are seldom made. When they are made the technical input required is usually filled by someone at the Designer level. And the emphasis is on the design of the gear rather than the drawing. When a gear or a gear train is shown on a drawing it is generally no more than a pair of concentric phantom circles on which have been drawn—from a template—three teeth. The directives for fabrication are accomplished by appended specifications or simply by calling out a vendor's catalog number. Your detailer will need to have been in the business for many long years before he will have occasion to fully design or draw a gear.

There are about 25 lead pencil grades. These are supplied as wooden pencils or as leads suitable for use in a mechanical pencil. Here again, common practice has reduced the usage to approximately three weights: H, 2H, and 4H. The H grade is used for lettering, the 2H is used for heavy lines, and the 4H for lines. There are exceptions, of course. The use of leads is beginning to be encouraged and the wooden pencil discouraged. Lead, in a mechanical holder, may be readily sharpened in a mechanical sharpener in a clean and one-handed operation. The wooden pencil needs either a special pencil sharpener or a pen knife, a very messy sanding block, and an equally filthy wiping rag.

These are just a few points, and I have chosen these mostly to indicat the overall industrial philosophy o achieving a considerable increase i productivity by effort reduction. A component draftsman cannot an should not be crowded into runnin faster. By cutting away unnecessar labor we have reduced his cost an increased his output.

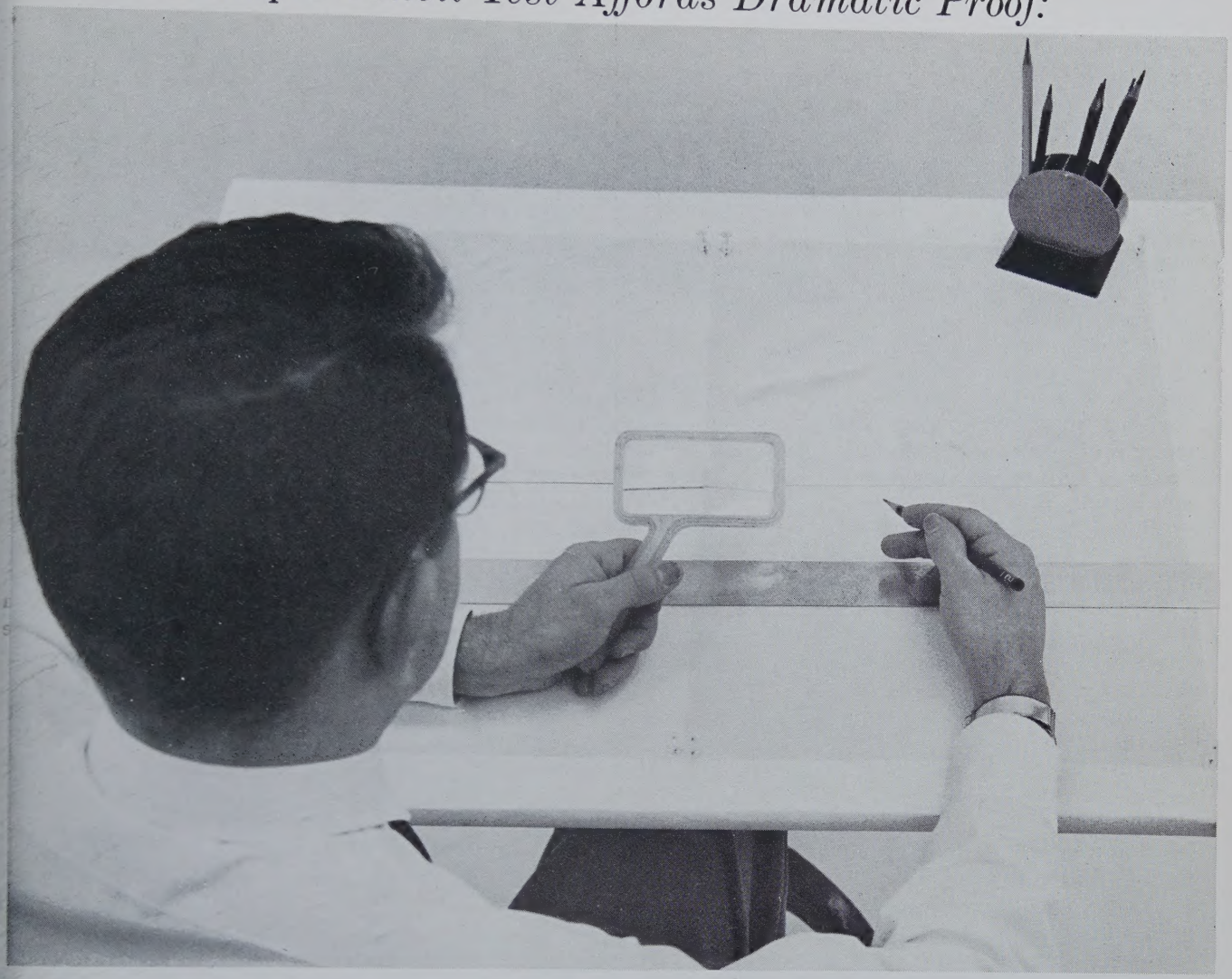
Today's craftsman is an importan part of our industrial complex. Hi contribution to our work is valuable We need and want more of him an we try very hard not to waste any o him. Nor can we afford to let hi waste any part of us. Educators mus be prepared to emphasize that engi neering drawing is technical commu nication. The engineer, the designe and the draftsman must each realiz that it is his skill as a communicato that will be the measure of his effec tiveness and the level of his career When he makes a drawing, or a sketch, or—for that matter—when h opens his mouth, what he says mus successfully achieve a transfer of in formation. His skills are a tool whic he will use to express ideas—some body else's ideas tomorrow, and pos sibly his own ideas the day after to morrow.

The Author

JOHN R. CARPENTER is associate with the Ballistic Missile Division Great Valley Laboratory, Burrough Corp., Paoli, Penna. He was one o the founders and charter members o the Design-Drafting Council of Dela ware Valley.

Advertising Index

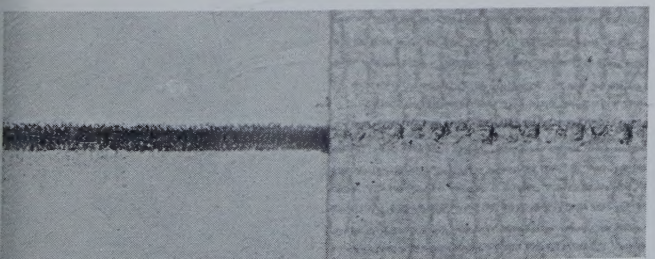
Simple Pencil Test Affords Dramatic Proof:



CRONAFLEX® HAS THE BEST DRAFTING SURFACE YOU CAN USE!

Here's an easy way to prove to yourself the superior draftability of CRONAFLEX: place a sheet of it on your drawing board, side by side with whatever drafting material you've been using. Now draft several lines on each. Erase and re-draft. Use your own tools, your own techniques.

Examine the lines you've drawn with a magnifying glass. Notice the difference in covering power, cleanness of erasures and line density—especially where lines have been re-drawn. You've just demonstrated three important reasons why CRONAFLEX is the best drafting film available: excellent *pencil acceptance*, outstanding *erasability* and good *re-drafting characteristics.*



Compare pencil acceptance of CRONAFLEX (left) with that of ordinary drafting material. Same pencil made both impressions! CRONAFLEX gives a faster, cleaner, lighter touch, too, because you don't have to bear down as you must with cloth.

CRONAFLEX has other advantages, as well. Its rugged "Cronar"* polyester base holds its size and resists kinking. It's .004″ thick for easier, more efficient handling. Because CRONAFLEX is manufactured from start to finish by Du Pont, you're assured of consistent performance found in no other drafting film. To learn more, write: E. I. du Pont de Nemours & Co. (Inc.), Photo Products Department, Wilmington 98, Delaware.

*Du Pont's trademark for its polyester photographic film base.

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

KOH-I-NOOR

Precision-Matched Instruments

Koh-I-Noor offers draftsmen an important new dimension in a comprehensive line of instruments and accessories meticulously matched to provide new high levels of professional performance, efficiency and convenience.

MODEL NO. 3060: The regular Koh - I - Noor Rapidograph "Technical" Fountain Pen with self-contained automatic filling system, and pocket clip is a standard drafting room tool.

MODEL NO. 3065: A new model with 7 interchangeable drawing point sections, each color-coded to indicate a different line width. Best buy for the professional who requires frequent change of line widths. Each drawing point section complete with airtight refillable ink cartridge. Interchange is accomplished quickly, cleanly. Comes in handy desk top container.

NOW...TWO KOH-I-NOOR *RAPIDOGRAPH*

TECHNICAL FOUNTAIN PENS

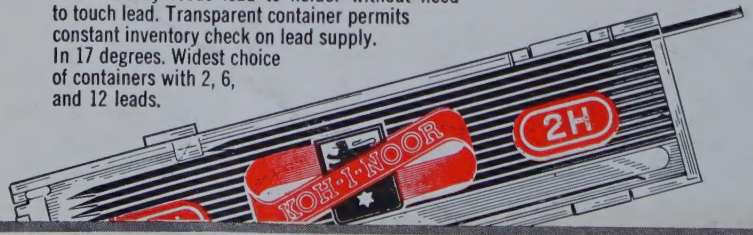
In 7 "color-coded" precision line widths: 00, 0, 1, 2, 2½, 3, 4. Uses India (or regular) ink for ruling, lettering, tracing or writing with equal facility.

(Write for catalog.)

Two Koh-I-Noor products designed to work together...for greater efficiency!

KOH-I-NOOR EJECTOMATIC LEAD DISPENSER

Automatically feeds lead to holder without need to touch lead. Transparent container permits constant inventory check on lead supply. In 17 degrees. Widest choice of containers with 2, 6, and 12 leads.



KOH-I-NOOR ADAPTO-CLUTCH LEAD HOLDERS

Widest choice of holders, all metal, perfectly balanced, with non-slip, turn-proof, replaceable clutch; knurled finger grip. With or without pocket clip, lead degree indicator, Color-Coded.

KOH-I-NOOR PENCIL CO., Inc.

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